calculus. The fact is, that nearly all the problems of the numerical calculation of perturbations which were urgent at the beginning of the century, in order to bind the solar system to the scheme of universal gravitation, have now been satisfactorily disposed of. There is no longer the same need for the greatest intellectual power to set itself to put right some periodic or secular inequality, which requires all the battery of analysis that is available, and often more. New ground has been broken since then, and there is the great array of the physical sciences, all struggling to become purely dynamical, but all hampered in this by the fact that the dynamical machinery, the phenomena of matter and motion, on which they depend, are to a great extent concealed from direct observation or exploration. Under such circumstances the method of progress is to carefully cherish, and reduce into a scheme such as will appeal directly to the understanding, all the general principles which have become evolved in the course of dynamical investigations relating to problems of which the data are thoroughly known; and to use them as a key for the dynamical interpretation of more recondite phenomena by the aid of analogies and the numerical verification of their results. The mode of progress has thus veered from the analytical to the synthetical, from the powerful inverse analysis of Laplace and Lagrange to methods more akin to those which were worked by Newton.

It may be stated as a general rule that the relations most directly intelligible and most flexible in this kind of application are properties of constancy, or of maximum and minimum, such as belong in fact to the more obvious features of the continuous growth of pure quantity. The conservation of energy, of linear momentum, of angular momentum, the minimum energy criterion of equilibrium, of steady motion, the maximum and minimum energy criteria which determine the motion following the application of impulses specified either by their actual amounts or by the velocities they produce at their points of application—these may all be cited in illustration. The crown of the edifice will be Maupertuis's principle of Least Action, whose range of exact application, initiated for dynamics by Lagrange and Hamilton, is now being extended into all departments of physics, thus working out an answer to the question—To what extent can the succession of phenomena in inanimate Nature from instant to instant be treated as governed by a principle analogous to that of minimum expenditure of effort in the sentient world?

The phrase from instant to instant is essential, for a path may—as, for example, a great circle on a sphere—be the shortest between two points within a given range of each other, but may cease to have that property when the starting point and the final point are taken too far apart on it. In a similar way, in statics, a certain region of stability is determined around each position of equilibrium, such that, if the system is not disturbed beyond that region, it will not leave the neighbourhood; while, in dynamics of a particle, such a region is more vaguely determined around each orbit by the nature of the enveloping curves or surfaces of the neighbouring orbits.

From the point of view of the direct appreciation of dynamical ideas, the small books at the head of this article form a very welcome addition to the ordinary text-books. The work of Prof. Perry, popular lecture though it be—and one feels constrained, from the confident style, to believe that his audience of operatives understood every word of it—leads on the reader by vivid illustration into contact with the boldest flights of dynamical speculation. After the ordinary effects of spin have been copiously illustrated, we are taken into a world in which matter has two kinds of inertia; and, by aid of a chain of balanced gyrostats, we learn that a cord cannot ever transmit motion straight on without also twiddling about. It is fortunate for those of us who have to follow or teach mechanical pursuits that this new species of matter is not often heard of, and is only called up in relation to such unnoticeable, and practically insignificant, phenomena as rotation of the plane of vibration of light waves. The relations of ordinary mass to gravitation, and such like are sometimes intricate enough things to discuss; the introduction of a second kind of mass, and that of a vector character, might lead to despair.

The great pioneer in this field of work, of eliciting the concealed dynamical mechanism of tangible phenomena, is, of course, Lord Kelvin, by whom nearly all our knowledge on the subject has been originated, at any rate in its present exact form. Prof. Perry's book is all the more welcome and suggestive, in that it claims to be chiefly a connected account of what he has learned at first hand from the teaching of Lord Kelvin; an account which has possibly not been published before by anyone, at least in a consecutive form.

Prof. Worthington, after an elementary quantitative introduction to dynamical principles, has gone over the part of dynamics of rotation which relates to a single spinning solid, in the manner of a text-book with numerical illustrations; and there is no doubt that a mastery of his explanations would be a very valuable part of the outfit of a student of physics.

J. L.

THE MAMMALIA OF BRITISH INDIA.

The Fauna of British India, including Ceylon and Burma. Published under the authority of the Secretary of State for India in Council. Mammalia. Part II. By W. T. Blanford, F.R.S. (London: Taylor and Francis, 1891.)

IN our issue of September 27, 1888, we had the pleasure of bringing before the notice of our readers the first part of Mr. Blanford's valuable monograph on the Mammals of British India. The second part, completing this important work, has lately been published. The delay, as is explained in the preface, has been caused by the necessity Mr. Blanford has been under of spending much time in editing the five volumes of the same series that have appeared since the first part of the present work was issued. His labours in this respect have been increased by two unfortunate and unforeseen circumstances—the lamented death of Mr. Francis Day, and the expiration of the leave of Mr. E. W. Oates, in both cases before the termination of the portions of the work, on fishes and birds respectively, upon which they were engaged, and the completion of which has thus fallen upon Mr. Blanford himself.

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In the preface of the present part, the origin of the series to which it belongs is thus related :—

> "The need for new and revised descriptive works had, for some years before 1881, been felt and discussed amongst naturalists in India, but the attention of the Government was, I believe, first called to the matter by a memorial dated September 15 of that year, prepared by Mr. P. L. Sclater, the well-known Secretary of the Zoological Society, signed by Mr. Charles Darwin, Sir J. Hooker, Prof. Huxley, Sir J. Lubbock, Prof. W. H. Flower, and by Mr. Sclater himself, and presented to the Secretary of State for India. This memorial recommended the preparation of a series of hand-books of Indian zoology, and my appointment as editor. It is scarcely necessary to add that to the recommendation of men so highly respected and well known in the world of science, the publication of the present 'Fauna of British India' is greatly due, and that Mr. Sclater is entitled to the thanks of all interested in the zoology of India for the important part he took in the transaction."

We are also glad to learn from the same source that the series of works on the fauna of British India will not be confined to the Vertebrata, the preparation of three volumes on Moths by Mr. G. F. Hampson having been commenced. We trust that these will be followed by others dealing with those groups of which sufficient material is available, and for which authors may be forthcoming capable of treating them in a manner worthy to be placed by the side of those already issued.

The second part of the Mammalia contains the orders Chiroptera, Rodentia, Ungulata, Cetacea, Sirenia, and Edentata. It is fully equal to its predecessor in careful selection of the material which is most likely to be useful and attractive to those readers for whom the work is chiefly intended. The descriptions, geographical distribution, and accounts of the habits of the various species can be thoroughly relied upon. Nomenclature is always a thorny subject in zoology, and though Mr. Blanford is usually most careful and judicious in his work in this department, we cannot agree with him in substituting the specific name of *maximus* for the time-honoured and universally used *Elephas indicus*. The inconvenience of changing the name by which such a familiar animal is designated in thousands of books and museums, is so great that it can only be justified by some more imperious necessity than appears to exist in the present case. That *maximus* was applied by Linnæus to both the then known species, and that it is incorrect and misleading (the other existing, and many of the extinct, species being as large as, or larger than, the Indian elephant) are sufficient reasons, in our judgment, for leaving the name in the oblivion in which it has slept for nearly a century. Moreover, if *indicus* be rejected, the claims of Blumenbach's *asiaticus* cannot be overlooked.

The illustrations of the present part are far superior to those of the former one, and show a marked advance in the art of process-printing directly from the artists drawings, without the intervention of the wood-cutter. Many of those by Mr. P. Smit, though printed from blocks in the text, have all the softness and delicacy of the finest specimens of lithography, and add greatly to the attractiveness of this valuable work.

W. H. F.

OUR BOOK SHELF.

Tanganyika: Eleven Years in Central Africa. By Edward Coode Hore, Master Mariner. (London: Edward Stanford, 1892.)

Mr. Hore was for eleven years a member of the Central African Mission established at Lake Tanganyika by the London Missionary Society, his special task being to undertake all the work that could be most effectually accomplished by one who had the knowledge and experience of a master mariner. In the present book he gives an account of his labours. The narrative contains many elements of interest, and will be read with pleasure by all who like to think of devoted courage in the service of great moral ideas. Mr. Hore became very familiar with Lake Tanganyika, which he surveyed in the first instance on board a native boat. Afterwards the British supporters of the mission enabled him to build two vessels in which he had opportunities of doing his work in a style worthy of its magnitude and importance. Of the physical characteristics of the lake and the surrounding regions he gives an unpretending but sound and sometimes picturesque account. He has also much to say about the natives, whose confidence and good-will he seems to have had a rare power of winning. He has a very favourable opinion of their capacities, and knows of no good reason why they should ever be treated by Europeans otherwise than with kindness and patience.

Beginner's Guide to Photography. By a Fellow of the Chemical Society. (London: Perken, Son, and Rayment, 1892.)

This very cheap and useful little guide has now reached its fourth edition. The reader is led through all the phases of manipulation that at first sight seem so bewildering, but which with clear explanations are soon rendered more simple and eventually mastered. All questions relating to "How to buy a Camera, and how to use it," may be said to be here fully answered, and by following the instructions an amateur may be saved from much disappointment and expense. The explanations throughout the book are both clear and explicit, and the omission of such technicalities as might confuse rather than enlighten a reader will be found distinctly advantageous.

Quain's Elements of Anatomy. Edited by E. A. Schäfer, F.R.S., and G. D. Thane. In Three Vols. Vol. II., Part 2. By Prof. Thane. Tenth Edition. (London: Longmans, Green, and Co., 1892.)

It is necessary here only to record the fact that the publishers have issued the second part of the second volume of this magnificent edition of Quain's standard work. The editor is Prof. Thane, and the subjects dealt with are arthrology, myology, and angeiology. There are no fewer than 255 illustrations, many of which are coloured.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* Nature. *No notice is taken of anonymous communications.*]

The Zebra's Stripes.

Almost every writer who treats of the colours of animals refers to Galton's observations that in the bright starlight of an African night zebras are practically invisible even at a short distance; but there can be no doubt that their peculiar striped appearance is also of great protective value in broad daylight. On a recent zebra hunt near Cradock, in which I took part, several members of our party commented on the difficulties of seeing

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